

AIR FORCE QUALIFICATION TRAINING PACKAGE (AFQTP)



**for
ENGINEERING
(3E5X1)**

**MODULE 14
DRAFTING**

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Career Field Education and Training Plan (CFETP) references from 1 Apr 97 version.

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ENGINEERING
(3E5X1)

INTRODUCTION

Before starting this AFQTP, refer to and read the “Trainee/Trainer Guide” located on the AFCESA Web site <http://www.afcesa.af.mil/>.

AFQTPs are mandatory and must be completed to fulfill task knowledge requirements on core and diamond tasks for upgrade training. *It is important for the trainer and trainee to understand* that an AFQTP **does not** replace hands-on training, nor will completion of an AFQTP meet the requirement for core task certification. AFQTPs will be used in conjunction with applicable technical references and hands-on training.

AFQTPs and Certification and Testing (CerTest) must be used as minimum upgrade requirements for Diamond tasks.

MANDATORY minimum upgrade requirements:

Core tasks:

AFQTP completion
Hands-on certification

Diamond tasks:

AFQTP completion
CerTest completion (80% minimum to pass)

Note: *Trainees will receive hands-on certification training for Diamond Tasks when equipment becomes available either at home station or at a TDY location.*

Put this package to use. Subject matter experts under the direction and guidance of HQ AFCESA/CEOT revised this AFQTP. If you have any recommendations for improving this document, please contact the Career Field Manager at the address below.

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DRAFTING

MODULE 14

AFQTP UNIT 1

PERFORM FUNDAMENTAL DRAFTING PRACTICES (14.1.)

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PERFORM FUNDAMENTAL DRAFTING PRACTICES***Task Training Guide***

STS Reference Number/Title:	14.1. Perform fundamental drafting practices
Training References:	<ul style="list-style-type: none">• 5 Level Career Development Course• Field Manual 5-553• Local procedures
Prerequisites:	<ul style="list-style-type: none">• Possess as a minimum a 3E531 AFSC
Equipment/Tools Required:	<ul style="list-style-type: none">• Manual drafting tools and media
Learning Objective:	<ul style="list-style-type: none">• The trainee will be able to identify basic steps and procedures in manual drafting
Samples of Behavior:	<ul style="list-style-type: none">• The trainee will be able to perform fundamental drafting procedures

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PERFORM FUNDAMENTAL DRAFTING PRACTICES

Background: Drafting is one of the most important communication methods you use as an engineer assistant. Drafting must convey the same meaning to everyone. Drafting has drastically become quick and easy with Computer Aided Drafting (CAD). Why do we need to learn the fundamentals of drafting when we have CAD which will do it all for us at the click of a mouse? The answer should be obvious. A draftsman can learn CAD quite easily while not any computer genius can grasp drafting symbology, principles, theories or methods. Look at CAD as a tool, not a discipline. Additionally, CAD cannot be used to its maximum potential without a firm grasp of drafting principles. By mastering drafting fundamentals, you will be able to prepare drawings for others to interpret and additionally, interpret the drawings of others.

To perform this task, follow these steps:

Step 1: Select drawing media

Determination of media depends on the purpose of the project. Vellum (tracing paper) is used mostly for sketch work, and polyester drafting film (Mylar) is a more durable product. Other drawing medias, i.e., white paper, manila paper, and green paper, are all good for pencil or ink drawings.

Step 2: Select size of drawing paper

The drawing paper should accommodate the drawing without being crowded or wasteful. Consider the size, type, and number of objects to be drawn, quantity of notes, border, and title block.

Sheet size	Engineering Standard	Architectural Standard
A	8 ½ x 11	9 x 12
B	11 x 17	12 x 18
C	17 x 22	18 x 24
D	22 x 34	24 x 36
E	28 x 40	30 x 42

Step 3: Select basic drafting equipment

This equipment consists of a drawing board, T-square/parallel bar, set of triangles, scales, pencils, ink, protractor, erasers, irregular curves, and a set of drafting instruments.

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Figure 1

- From a center point called O, in figure 1, draw a circle with a radius equal to R_1 minus R_2 . R_1 and R_2 can be any values you chose
- Draw a tangent from this new circle to O_1 , using figure 2 and the next three steps as a guide to construct a tangent to a circle
- Draw a construction line from P to O, the center of the circle. Then bisect this line
- Using $\frac{1}{2}$ of the line PO, strike an arc that cuts the given circle at T
- Draw the line PT, which is the required tangent line
- Extend line OT until it intersects circle O at T_1 .
- Draw a line parallel to OT from center O_1 to intersect the second circle at T_2 .
- Draw line $T_1 T_2$ which is the required tangent.

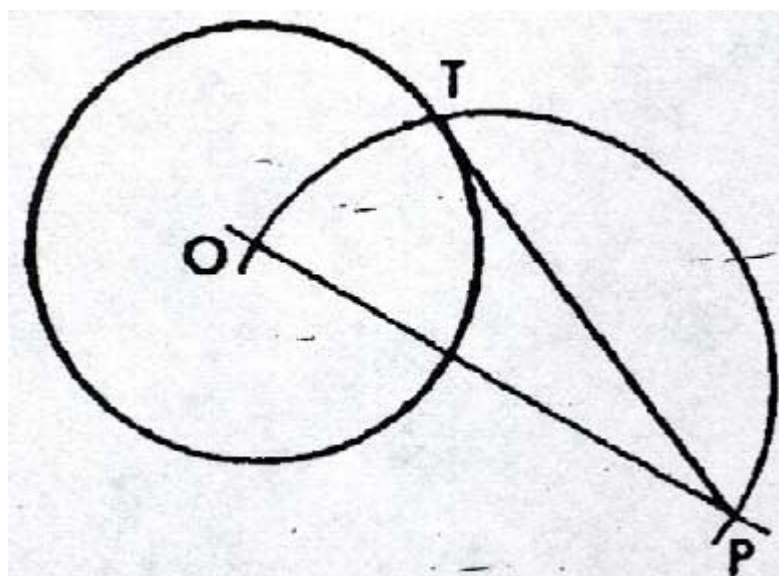


Figure 2

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Step 5: Draw to scale a plot plan of your building

Show the boundaries of the construction site (using your existing building) and the location of the building in relation to these boundaries.

Step 6: Draw to scale a floor plan of your office

Obtain this view by visualizing that a horizontal cutting plan passes through your building in such a way that it cuts through all walls, doors, and windows.

Step 7: Draw a detail plan of a door jam for the door to your office

Show the detail of the door with greater exactness than the small scale taken from the office.

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**Review Questions
for
Perform Fundamental Drafting Practices**

Question	Answer
1. Computer Aided Drafting has eliminated the need to know the fundamentals of manual drafting?	a. True b. False
2. Which type of media is most commonly used for sketch work?	a. White paper b. Manila paper c. Vellum d. Mylar
3. What item is NOT part of basic drafting equipment?	a. Pencils b. 100' tape c. Triangles d. Protractor
4. What sheet size would represent 22" x 34"?	a. A b. B c. C d. D

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PERFORM FUNDAMENTAL DRAFTING PRACTICES

Performance Checklist		
Step	Yes	No
1. Can trainee select correct drawing media?		
2. Can trainee, given project data, calculate size of drawing media?		
3. Can trainee select basic drafting equipment to start a drawing?		
4. Can trainee draw a plot plan?		
5. Can trainee draw a floor plan?		
6. Can trainee draw a detail?		

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the minds of both the trainee and trainer.

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DRAFTING

MODULE 14

AFQTP UNIT 3

REVIEW COMPLETE PROJECT DRAWINGS (14.3.)

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REVIEW COMPLETE PROJECT DRAWINGS***Task Training Guide***

STS Reference Number/Title:	14.3. Review complete project drawings
Training References:	<ul style="list-style-type: none"> • 5-Level Career Development Course • Local procedures • Architectural Graphic Standards, Ramsey/Sleeper, Ninth Edition
Prerequisites:	<ul style="list-style-type: none"> • Possess as a minimum a 3E531 AFSC
Equipment/Tools Required:	<ul style="list-style-type: none"> • Manual drafting tools and media
Learning Objective:	<ul style="list-style-type: none"> • The trainee will be able to identify areas on project drawings to be reviewed for completeness
Samples of Behavior:	<ul style="list-style-type: none"> • The trainee will be able to perform the project review process for completeness and accuracy • Identify correct drafting industry symbols

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REVIEW COMPLETE PROJECT DRAWINGS

Background: One cannot understate the criticality of the drawing review process. The product you are about to release will soon become working drawings for construction crews and legal binding contracts obligating the government. Future changes will not only delay project schedules but will be costly to the government. This is a critical review requiring a critical mind and eye. Keep in mind this is **NOT** a constructibility review, which is covered in AFQTP 18.3.

To perform this task, follow these steps:

Step 1: Check general items

- Legibility - lettering in notes, legends, schedules, scales, and dimensions readable
- Neatness - sheets clear of smears, smudges, and stray mark
- Accuracy - spelling, dimensions, notes, and references (detail/section) correctly transcribed
- Check all pages for proper numbering
- Location of haul routes and borrow pits correct pointed out

Step 2: Review Sequence of Sheets

- Sequence of sheets should follow CSI format when possible. Normal sequence of drawings are:

(1) Title Sheet	(6) Floor Plan
(2) Site Plan	(7) Elevations
(3) Plot Plan	(8) HVAC Plan
(4) Foundation Plan	(9) Plumbing Plan
(5) Framing Plan	(10) Electrical Plan
- Sections and details should be displayed on sheet taken from and always within sheets of that discipline

Step 3: Check if drawing lines are clear and represent intended entity

- Line weights uniform for object outlines, dimension, extensions, hidden, cutting planes, leaders, borders, and contours
- New entities stand out over existing
- Utilities clearly marked and labeled
- Match lines for continuation sheets match
- Check for open corners, lines crossing, and missing lines
- Lines can be seen when reproduced

Step 4: Check dimensions are properly placed

- Spacing criteria satisfied
- Leaders and extension lines are clear to what they reference
- Crossing lines avoided or breaks made when needed
- Dimensions can be read from the bottom and right sides only

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Step 5: Ensure symbols are used correctly

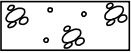
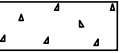




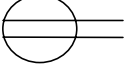





- Section - properly numbered and referenced
- Detail - properly numbered and referenced
- Welding - correct placement and use
- Objects - properly scaled or noted as 'Not to Scale'
- Material - uniform, established legend of materials used
- Standardization - industry standard symbols should be used; if not, be uniform throughout

Step 6: Ensure plans are “modeled” after the base plan

- Electrical, mechanical, plumbing, system furniture, and remodeling plans match floor plan
- Plans do not interfere or overlap other plans (e.g. electrical lights and HVAC vents)
- Utility, plot, and landscape plans match existing site plan

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Review Questions for Reviewing Complete Project Drawings

Question	Answer
1. What sequence should the drawing sheets be in?	a. In the standard CSI format b. In the standard SCI format c. In the standard ICS format d. In the standard SIC format
2. The importance of checking your drawings should not be minimized but should be the pinnacle of the drafting process?	a. True b. False
3. Electrical plans should be reviewed with mechanical plans?	a. True b. False
4. Review complete project drawings and constructibility review are considered the same?	a. True b. False
5. How should new items be shown with existing items?	a. For clarity they should stand out with darker lines b. It does not matter, it is not a significant detail c. For clarity they should stand out with lighter lines d. For clarity, they should not stand out
6. Which of the following is the correct symbol for pre-cast concrete?	a.  b.  c. 
7. Which of the following is the correct symbol for a building section?	a.  b.  c. 
8. Which of the following is the correct symbol for a duplex receptacle outlet?	a.  b.  c. 
9. Which of the following is the correct symbol for a supply duct section?	a.  b.  c. 

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REVIEW COMPLETE PROJECT DRAWINGS

Performance Checklist		
Step	Yes	No
1. Can trainee recognize general items on the drawings?		
2. Can trainee sequence drawings?		
3. Can trainee recognize incorrect drafting practices on drawings?		
4. Can trainee recognize correct placement of dimensions?		
5. Can trainee recognize correct symbols on drawings?		
6. Can trainee recognize if plans are “modeled” after the based plan?		

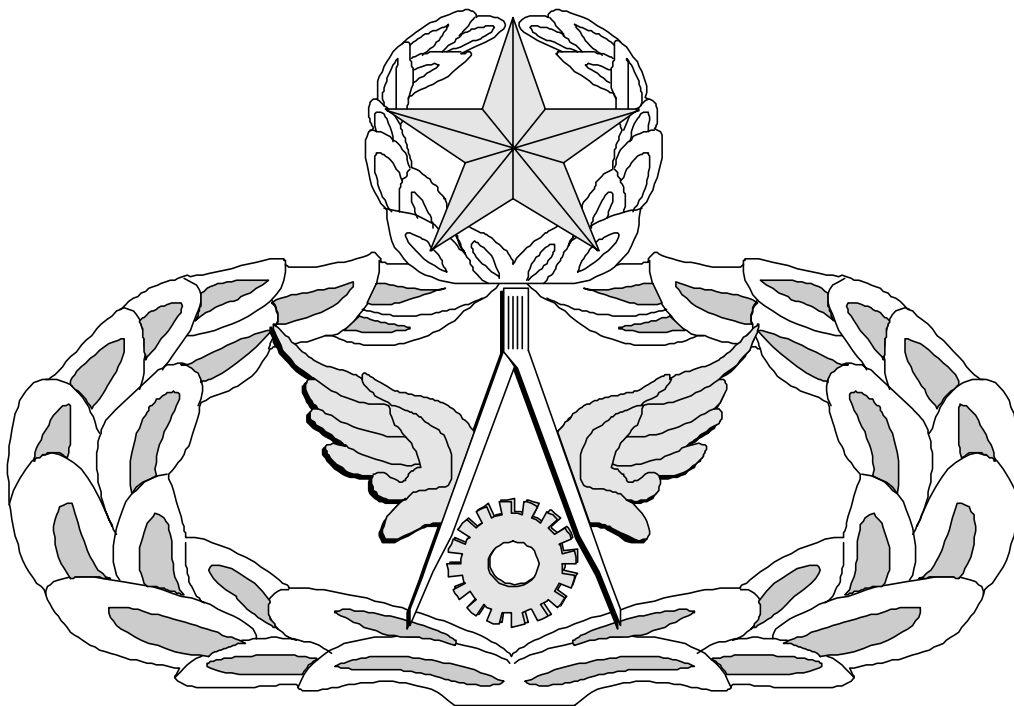
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Air Force Civil Engineer

QUALIFICATION TRAINING PACKAGE (QTP)

REVIEW ANSWER KEY



for
ENGINEERING

(3E5X1)

MODULE 14

DRAFTING

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Key-1

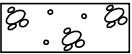

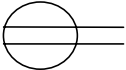

PERFORM FUNDAMENTAL DRAFTING PRACTICES**(3E5X1-14.1.)**

Question	Answer
1. Computer Aided Drafting has eliminated the need to know the fundamentals of manual drafting?	b. False
2. Which type of media is most commonly used for sketch work?	c. Vellum
3. What item is NOT part of basic drafting equipment?	b. 100' tape
4. What sheet size would represent 22" x 34"?	d. D

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REVIEW COMPLETE PROJECT DRAWINGS

(3E5X1-14.3.)

Question	Answer
1. What sequence should the drawing sheets be in?	a. In the standard CSI format
2. The importance of checking your drawings should not be minimized but should be the pinnacle of the drafting process?	a. True
3. Electrical plans should be reviewed with mechanical plans?	a. True
4. Review complete project drawings and constructibility review are considered the same?	b. False
5. How should new items be shown with existing items?	a. For clarity they should stand out with darker lines.
6. Which of the following is the correct symbol for pre-cast concrete?	a. 
7. Which of the following is the correct symbol for a building section?	a. 
8. Which of the following is the correct symbol for a duplex receptacle outlet?	a. 
9. Which of the following is the correct symbol for a supply duct section?	b. 

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